

Citation:

Towns RE, Cullen RW, Memken JA, Nnakwe NE. Food safety-related refrigeration and freezer practices and attitudes of consumers in Peoria and surrounding counties. *J Food Prot.* 2006; 69: 1,640-1,645.

PubMed ID: [16865898](#)

Study Design:

Cross-sectional study

Class:

D - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine consumer practices of and attitudes toward proper refrigerator and freezer storage techniques in relation to food storage to determine the relationships of gender, age, education and income to those practices and attitudes.

Inclusion Criteria:

Households, with complete addresses, from the 2004 telephone book of Peoria County (Illinois) and surrounding areas.

Exclusion Criteria:

- Households outside of the 2004 telephone book of Peoria County (Illinois) and surrounding areas
- Households from the 2004 telephone book of Peoria County (Illinois) and surrounding areas, without complete addresses.

Description of Study Protocol:**Recruitment**

- Random sample of 500 households with complete addresses from 2004 telephone book of Peoria County (Illinois) and surrounding areas
- Surveys were sent by US mail on January 3, 2005 and returned January 10 through February 15, 2005
- Self-addressed, stamped envelope and cover letter were included to explain purpose of the research

- Returned surveys signified consent of participation.

Design

- A random sample survey was conducted to examine attitudes and practices of proper refrigeration and storage techniques of consumers in Peoria County, Illinois and determine whether demographic factors have an effect on those variables
- Survey consisted of five demographic questions, including 12 food storage and sanitation practice questions, and 11 attitudinal questions concerning knowledge of and attitudes toward proper refrigeration and freezer food storage techniques (only 10 practice and 11 attitudinal questions were used in the analyses).

Statistical Analysis

- The Statistical Package for Social Sciences for Windows (version 12.0, 2003) was utilized to perform statistical analyses
- Descriptive statistics (frequencies, means, standard deviations and percentages) were calculated to describe demographic characteristics and refrigerator and freezer practices and attitudes
- A one-way ANOVA was used to evaluate the relationship between refrigeration and freezer storage practices, attitudes and demographic variables (differences significant at $P < 0.05$)
- For practice questions and demographic questions, missing data were eliminated from the study
- Practice portion of survey: Total score was calculated by assigning a value of one to correct responses and a value of zero to incorrect responses; the maximum possible score was 10
- Attitudinal portion of the survey:
 - Likert scale measured strength of respondents' feelings about each statement; one indicated strong agreement and six indicated strong disagreement
 - Scores were lower for participants who considered food storage to be more important
 - Average attitudinal scores for respondents were calculated by dividing the sum of rankings for each item by the total number of questions
- Face validity tested by graduate students in a research methods course
- Internal consistency for attitudinal portion evaluated with Cronbach's alpha and scored 0.87.

Data Collection Summary:

Timing of Measurements

Surveys were sent by US mail on January 3, 2005 and returned January 10 through February 15, 2005.

Dependent Variables

- Overall mean scores for 10 food storage and sanitation practice questions (the questions focused on how respondent stored ready-to-eat and cooked foods in the refrigerator and freezer and whether the respondent was the primary meal provider)
- Overall mean scores for 11 food storage attitudinal questions (the questions covered importance respondents attached to storing food correctly and whether they thought they have ever suffered from a foodborne illness).

Independent Variables

- Gender
- Age
- Education
- Income.

Description of Actual Data Sample:

- *Initial N*: 500 surveys sent to randomly selected sample of consumers in Peoria County, Illinois
- *Attrition (final N)*: 16.3% (81) surveys were returned
- *Age (years)*:
 - 7.4 %: 18 to 29
 - 17.3%: 30 to 39
 - 29.6%: 40 to 49
 - 22.2%: 50 to 59
 - 12.3%: 60 to 69
 - 11.1%: 70 years or older
- *Other relevant demographics*:
 - 69.1% of participants were female (30.9% males)
 - 8.2% graduate school or higher; 40.7% college diploma; 14.8% high school diploma
 - 91.4% had self-reported total household income higher than \$60,000 (note that this figure in study appears to be incorrect); 11.1% reported \$45,000 to \$59,000; 8.6% reported \$35,000 to \$44,999; 14.8% reported \$20,000 to \$34,999 and 8.6% reported \$20,000 or less
- *Location*: Peoria County (Illinois) and surrounding areas.

Summary of Results:

Key Findings

- Reported consumer practices (scores in parentheses):
 - Total mean scores similar for men (5.28 ± 1.72) and women (5.29 ± 2.16)
 - Individuals with highest mean score:
 - 50 to 59 years (5.67 ± 2.54)
 - Had associate or technical degree (5.80 ± 2.28)
 - Reported total household income \$35,000 to \$44,999 (5.71 ± 2.14) or \$45,000 to \$59,000 (5.67 ± 2.83)
 - Individuals with lowest mean score:
 - 18 to 29 years (4.50 ± 1.87)
 - Had post-baccalaureate experience (4.94 ± 2.11) or attended high school, but did not receive a diploma (4.67 ± 1.53)
 - Reported a total household income less than \$20,000 (3.71 ± 0.76)
 - One-way ANOVA found no significant differences between total mean scores of self-reported practices with the independent variables of gender, age, education level and income
- Responses to government-established refrigeration and freezer consumer practices:
 - 75.3% did not have a thermometer in their refrigerator; 87.7% did not have a thermometer in their freezer

- 80.2% thawed frozen meat in the refrigerator and 55.6% correctly stored it near the bottom shelf of the refrigerator
- 63.0% wrapped up and 48.1% stored hot leftover food in the refrigerator as soon as the meal was completed
- 100.0% reported wrapping or covering food before placing it in the refrigerator
- 51.9% incorrectly cooled hot leftover food to room temperature on counter before storing in the freezer
- 98.8% did not store hot leftover food at room temperature overnight
- 95.0% correctly reported storing cooked foods near the top or middle shelves of the refrigerator
- 51.9% incorrectly let hot leftover soup cool to room temperature before placing it in the refrigerator, but 80.2% correctly put it into smaller containers first
- 16.0% correctly stored raw eggs near the bottom shelf of the refrigerator and 38.3% stored raw eggs near the middle shelf of the refrigerator
- 30.9% received a total score higher than 6.0 for the 10 practice questions (69.1% received a total score of less than 6.0 for those 10 questions).

Other Findings

Consumer attitudes (scores in parentheses):

- Overall, mean attitudinal scores of participants were low (1.71 ± 0.60), indicating most participants thought it was important to take proper steps to prevent food-borne illnesses in their homes
- Male participants had the lowest mean attitudinal score (1.72 ± 0.52) and thought it more important to take steps to prevent food-borne illnesses in the home than did female participants
- Individuals 18 to 29 years of age (1.90 ± 0.51) thought it was less important to prevent food-borne illness than all other age groups
- Those who attended high school but did not graduate, had the lowest mean scores for attitude (1.33 ± 0.23); the highest score among the education categories was for college graduates (1.87 ± 0.59)
- Individuals who had a household income less than \$20,000 thought it was more important to take steps to prevent food-borne illness in the home (1.37 ± 0.20) than participants in other income categories
- One-way ANOVA found no significant differences between mean scores for various attitudes about food storage with respect to gender, age, education level and income.

Author Conclusion:

- Although individuals completing the survey were concerned about proper refrigeration and freezer storage practices, proper refrigeration and freezer food storage techniques were not typically practiced in their homes
- In general, survey participants' low attitudinal scores reflected their correctly identifying government-recommended safe food storage practices for preventing food-borne illness; however, their low practice scores indicated they were not following these guidelines
- No significant relationships ($P < 0.05$) were found within this sample population. For example, no significant relationships were found between practice and attitude scores

among demographic groups (non-significant findings showed attitude scores highest among 18- to 29-year-olds, those with college diploma, and with total household income level \$20,000 to \$34,999; and self-reported practice scores highest among 50- to 69-year-olds, those with technical or associate degrees and with total household income level \$35,000 to \$44,999)

- There were no significant differences between the practice and attitude scores of male and female participants (i.e., women were not more concerned about proper food storage techniques and were not more likely to practice proper food storage techniques than men, a finding inconsistent with those of other studies)
- The lack of knowledge and unsafe behaviors found in all income and education categories suggest health educators and government agencies should pay attention to all population sub-groups when designing information programs
- The results of this study may be used as a guide for designing nutrition intervention programs designed to assist people in becoming aware of why proper refrigeration and freezer storage practices are important, and to encourage the use of educational materials to inform consumers of current government refrigeration and freezer storage guidelines.

Reviewer Comments:

- *Results based on self-reported data that could introduce bias*
- *Low response rate (16.3%) and observation that majority of respondents (91.4%) reported a total household income of more than \$60,000 (although this demographic finding appears incorrect) limits generalizability of study results.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	Was the research question clearly stated?	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes

1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	Was the selection of study subjects/patients free from bias?	???
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	No
2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	Were study groups comparable?	N/A
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	N/A
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	N/A
4.4.	Were reasons for withdrawals similar across groups?	N/A

4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes

7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	Are conclusions supported by results with biases and limitations taken into consideration?	No
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	No
10.	Is bias due to study's funding or sponsorship unlikely?	No
10.1.	Were sources of funding and investigators' affiliations described?	No
10.2.	Was the study free from apparent conflict of interest?	???